FRD Activities Report
May 2003

Research Programs

JOINT URBAN-2003

Preparations are in full swing for deployment to Oklahoma City next month. Sixty-five new samplers are being constructed along with 325 new cartridges into which they will be inserted when deployed. All new sample bags were purchased for the new samplers and for replacement of all bags in the existing cartridges, of which there are 667. During the course of bag installation/replacement, it was discovered that more than 10% of the bags leaked. This set off a series of leak detection experiments. The leak was discovered around the plastic nipple. The manufacturer of the bags was notified who promptly replaced the bad bags.

The Tracer Analysis Facility (TAF) also underwent several tuning steps. The dynamic range was tested to see if it could be extended without a compromising residual contamination effect. Several sample loop sizes were also tested. Currently, the highest concentration that can be routinely measured is 35,000 ppt. Concentrations up to 200,000 ppt will require different handling.

Extensive testing was also undertaken to improve the method limit of detection (MLOD). The MLOD is the limit of detection applied to the entire handling and analysis method, from the initial cleaning of the bags, to their deployment in samplers and finally to their analysis on a gas chromatograph. Through additional cleaning of the bags and other precautions, we were able to cut our MLOD at least in half. It is now comfortably at the SF_6 background level, which is 3 ppt.

The SF_6 tracer release mechanisms were prepared during May. Two puff release mechanisms were obtained from Dugway Proving Ground and inspected for adequate operation. Unfortunately, the two systems leaked a substantial amount of SF_6 and they also made a very loud bang when opened. The noise level was so high that there would be cause for alarm if these were used in downtown Oklahoma City. A balloon filling and bursting procedure was subsequently devised which would provide the same functionality without the noise. The continuous release mechanism was also prepared and tested.

The final draft of the experimental plan was received from the science team lead. The plan is rather complicated, the result of many divergent opinions of the modelers and the requirements of experimentalists. It will require high attention to detail when fielding our 150 bag samplers. We will also deploy 10 real-time SF_6 analyzers for measuring both puffs and plumes of SF_6, as well as a sodar system. (Kirk.Clawson@noaa.gov and staff)

CLAST-High

Preparations continue for the upcoming 2003 hurricane season. Lab work on the BAT instruments and data system for the P3 was completed. Calibrations were completed. A battery of tests to assure the equipment is working properly has been conducted. The equipment was shipped to NOAA's Aircraft Operations Center, MacDill AFB at the end of May. Installation is scheduled for the first of June with test flights scheduled for late July. Changes/modifications to the system that was flown during the 2002 hurricane season include an improved aluminum hemisphere that is more robust and less labor intensive (and therefore less expensive) in construction, improved mirrors for the IRGA (the original silver-plated mirrors were badly corroded), and an improved software package for the data system. Upgrades continue on the data system software; these are expected to be completed prior to the test flight in July. (Jeff.French@noaa.gov)

ET Probe

Further field tests of the ET probe were conducted in May. The tests performed in late April showed some minor problems with the data acquisition system. These were quickly fixed. A more serious problem cropped up early in May when additional road tests were performed with the ET probe mounted on a pickup truck. The system worked well for the first few minutes on the road, but then started to show unusual voltage fluctuations which corrupted the pressure data. Annoyingly, the system often started working properly again after the truck was driven back to FRD and parked. Eventually, it was found that the USB hub used for communication between the AD boards and the notebook computer was overheating. This hub must be "self-powered", because the computer cannot supply sufficient power through its USB port to run both AD boards. Power was supplied by a DC/AC inverter connected to the truck's battery, and this supply suffered from large voltage surges depending on engine output. The problem was fixed by running the entire ET probe system off a small gasoline generator placed in the truck's bed.

A highly successful field test was conducted on 15 May, when the truck-mounted ET probe was driven out to INEEL and operated at a fixed location for several hours near a sonic anemometer. Ambient winds were about 10-20 m/s on this day, which is sufficient for the probe to operate properly. Intercomparisons of the ET probe and sonic data are just getting started. Data were also collected during the drive to and from the INEEL, with the probe operating side-by-side with a cup anemometer. During the westbound drive from Idaho Falls to the INEEL, the probe and cup-anemometer wind speeds matched very closely, as shown in the top plot of Figure 1. However, during the return

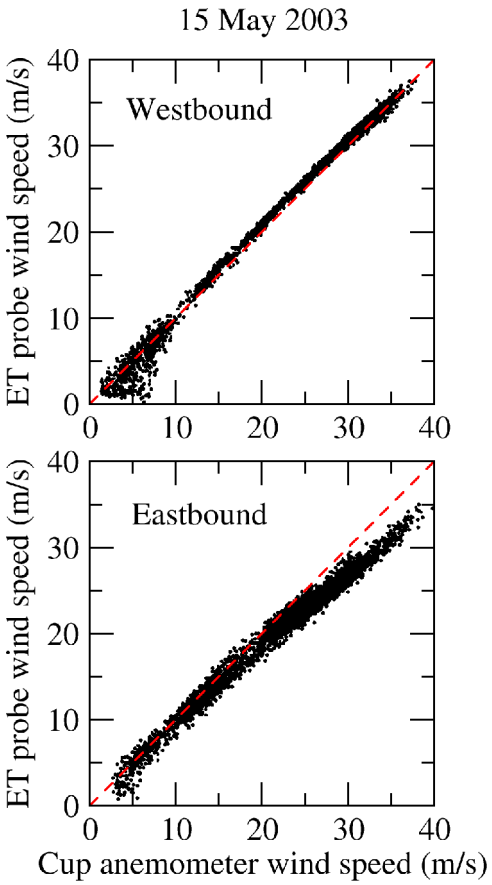

Figure1: Comparison between cup anemometer and ET probe wind speeds during a round trip from Idaho Falls to INEEL. The top plot is the westbound leg, and the bottom plot is the eastbound leg.

(eastbound) drive the ET speeds tended to fall below the cup speeds beyond about 20 m/s (bottom plot in Figure 1).

A different part of the sphere was facing forward during the return drive, so the first thought was that some of the pressure sensors were improperly calibrated. A recalibration was performed, but this did not correct the problem. It now appears that the problem lies with the instrument mounts on the truck. For one thing, the ET sphere and cup anemometer may be too close together, so that the cups are affected by the flow distortion around the ET sphere. Another possible issue is flow distortions caused by the truck itself. Also, the cup anemometer is mounted on a short crossarm attached to a vertical pipe. If the truck is traveling in a direction such that there is a crosswind coming from the right, the cup anemometer can easily come into the wake of the vertical pipe. As it turns out, the westbound drive on 15 May was during the late morning with a moderate crosswind from the left of the truck. The return trip was during the windiest part of the day, with a crosswind from the right. Further tests are planned to see if the problem can be eliminated by adjusting the sensor locations to avoid any wake effects on the sensors.
(Richard.Eckman@noaa.gov, Tom Strong)

Rain In Cumulus over the Ocean (RICO)

A Letter of Intent for proposal was sent to NOAA/OGP outlining our goals in RICO and our intent to submit a proposal to OGP. The proposal is in preparation, co-PIs include Jeff French, Bart Geerts and Gabor Vali (University of Wyoming). A request was submitted to the NSF facility pool for use of the KingAir in RICO. 120 flight hours were requested to investigate cloud interaction and cloud microphysics as part of RICO. (Jeff.French@noaa.gov)

ARL Aircraft

Jeff French visited with numerous scientists in the Boulder labs to discuss possible future collaboration utilizing the Velocity. Various avenues for possible collaboration were explored including using the aircraft to investigate indirect aerosol effects on solar radiation utilizing microwave remote sensing techniques (ETL) and CO_2 transport and variability (CMDL). Discussion with the group at SSRB focused on the possible usage of the aircraft to investigate radiation budgets and the feasibility of measuring radiation from that platform.
(Jeff.French@noaa.gov)

Cooperative Research with INEEL

Emergency Operations Center (EOC)

An INEEL Emergency Operations Center drill was conducted on May 5th in preparation for the annual site-wide exercise next month. Kirk Clawson and Brad Reese responded to a mock sulfuric acid tanker truck spill at INTEC. (Kirk Clawson@noaa.gov & Brad Reese)

INEEL Support

As reported last month, the 2002 annual dispersion estimates for the INEEL were completed in April. These estimates are used in INEEL's Annual Site Environmental Report. In May the main contractor responsible for the annual report requested some changes in the model estimates. During the last couple of years, the annual dispersion estimates were obtained by splitting up a unit release among the various facilities located within the INEEL. The contributions from all the facilities were then summed to provide a composite dispersion estimate for the entire site. The contractor is now requesting that individual unit releases be modeled for each separate facility. This was done in May, and the new model results were sent to the contractor. It will now be up to the contractor to apply the appropriate source terms for each facility if they want to produce a composite estimate for the whole site. (Richard.Eckman@noaa.gov)

In late May FRD received a request from the INEEL to comment on proposed requirements for the availability of the NARAC dispersion modeling system. The proposed DOE Notice would require all DOE facilities to have NARAC available, even though it does not require it to be the primary modeling system. FRD sent a list of comments regarding the proposed requirements, and how they could potentially affect FRD's support to INEEL. The modeling currently in use at FRD has a number of safeguards to account for possible losses of communication infrastructure (e.g., internet, phone lines). Moreover, FRD has significant expertise in the local meteorology at INEEL. These capabilities would be difficult to maintain if reliance is placed on a modeling system based at a remote site. (Kirk Clawson@noaa.gov, Richard Eckman)

Other Activities

Personnel

In a telephone conference with FRD employees on May 30, Bruce Hicks (Director, Air Resources Laboratory) announced that the recruitment process for FRD Director has been completed. The position became vacant with the death of Dr. Timothy Crawford in August, 2002. The new director will be Dr. Kirk Clawson, who has been Acting Director since Dr. Crawford's death. Kirk has been with FRD since 1986 and has been Deputy Director since 1998. He has a broad background in meteorological research, and is well qualified. We are looking forward to a great future for FRD under Kirk's leadership.

Papers Reviewed

A manuscript titled *Evaluation of two temperature stress indicies to estimate grain sorghum yield and evapotranspiration* was reviewed for Agronomy Journal by Kirk Clawson.

Travel

Jeff French 5-4 to 5-7 Boulder for ARL aircraft meeting; Laramie for Rico proposal

Kirk Clawson 5-12 to 5-17 To prepare logistics for the upcoming Joint Urban 2003 experiment in June-July.

Kirk Clawson and Randy Johnson 5-8 Dugway Proving Grounds to inspect and transport tracer release equipment for Joint Urban 2003 experiment.